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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/965,370	09/26/2001	Hua Chung	APPM/6303/CPI/COPPER/TJS	6507

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7590 11/17/2004

EXAMINER

FULLER, ERIC B

ART UNIT PAPER NUMBER

1762

DATE MAILED: 11/17/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

09/965,370

Applicant(s)

CHUNG ET AL.

Examiner

Eric B Fuller

Art Unit

1762

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 30 August 2004.  
2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.  
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-7, 9-42 and 44-69 is/are pending in the application.  
4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.  
5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.  
6) ☒ Claim(s) 1-7, 9-42 and 44-69 is/are rejected.  
7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.  
8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.  
10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).  
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)  
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)  
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 1.  
4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date: \_\_\_\_\_.  
5) ☐ Notice of Informal Patent Application (PTO-152)  
6) ☐ Other: \_\_\_\_\_.

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-7, 9-31, 33-42, and 44-69 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lopatin et al. (US 6,368,954 B1) in view of Pavate et al. (US 2002/0088716 A1).

Lopatin teaches a process of forming a barrier layer of tantalum, tungsten, or titanium, and nitrides or silicides thereof (column 5, lines 19-25). The barrier layer is formed by ALD to a thickness of 20-300 angstroms (column 5, lines 29-31). Two copper seed layers are taught and are formed by ALE or CVD (column 5, line 40 - column 6, line 54). The bulk copper layer is deposited by CVD (column 6, lines 55-67). The reference is silent to the seed layer comprising aluminum.

However, Pavate teaches that copper seed layers comprising .01 % to 5% aluminum cause the bulk copper layer above to be more resistant to electromigration (paragraphs 0020-0022; claim 6). It would have been obvious at the time the invention was made to a person having ordinary skill in the art to include .01% to 5% of aluminum in the copper seed layer of Lopatin. By doing

so, one would reap the benefits of the bulk copper layer being more resistant to electromigration.

As to claims 42 and 44-69, the claims read "less than about 20 angstroms" (emphasis added). It is the position of the examiner that 20.00001 is "about 20 angstroms". Since 20 is less than 20.00001, the reference anticipates "less than about 20 angstroms".

Claims 32, 42, and 44-69 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lopatin et al. (US 6,368,954 B1) in view of Pavate et al. (US 2002/0088716 A1), as applied to the claims above, and further in view of Tsai et al. (US 6,309,964 B1).

Lopatin, in view of Pavate, teach the limitations above. In the event the applicant does not agree with the examiner's position that 20 angstroms reads on "less than about 20 angstroms", the examiner has provided Tsai. Tsai teaches barrier layers of the same material being effective at a thickness of 10 angstroms (column 3, lines 40-46). It would be apparent to one of ordinary skill that this would use less material and/or would decrease the size of the semiconductor. It would have been obvious at the time the invention was made to a person having ordinary skill in the art to use a thickness of 10 angstroms for the barrier layer in the process taught by Lopatin, in view of Pavate. By doing so, one would reap the benefits of using less material and/or creating a smaller semiconductor, while still producing an effective barrier layer. This also reads on claim 32.

### ***Response to Arguments***

Applicant argues that the amendments overcome the prior art made of record. Examiner agrees and has withdrawn the rejections to the amended claims accordingly.

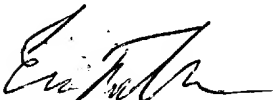
Applicant argues that the prior art of the previous Office Action failed to teach the thickness of unamended, independent claim 30. This argument has been found convincing and the rejections of the previous Office Action have been withdrawn accordingly. Applicant's arguments are moot in view of the new grounds of rejection, which explicitly teach the required thickness.

### ***Conclusion***


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eric B Fuller whose telephone number is (571) 272-1420. The examiner can normally be reached on Mondays through Thursdays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Shrive P Beck, can be reached on (571) 272-1415. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



EBF



TIMOTHY MEEKS  
PRIMARY EXAMINER